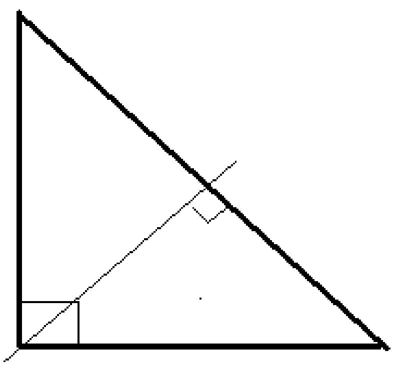
Crusty Calculations

by Joe Pawlak AKA Mathdude

Breakfast is my favorite meal
Especially if I cut the following deal;
To share a turnover with my spouse
It's sliced in half, yet I play the louse.

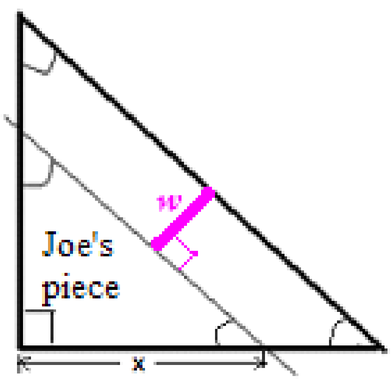
A generic turnover forms half a square or box
I'll use my math to play the fox.
Half the pastry she still will get,
But she's cheated with the following fix.



the normal way

Instead of cutting it the 'normal' way
In which two smaller half boxes are formed, I may
Along another line cut this morning wedge
Which parallels the longest edge.

Her piece now contains the turnover's fold.
My piece most of the filling will hold.
In this fashion I retain the fruit for which I lust,
While she gets naught but flakes and crust

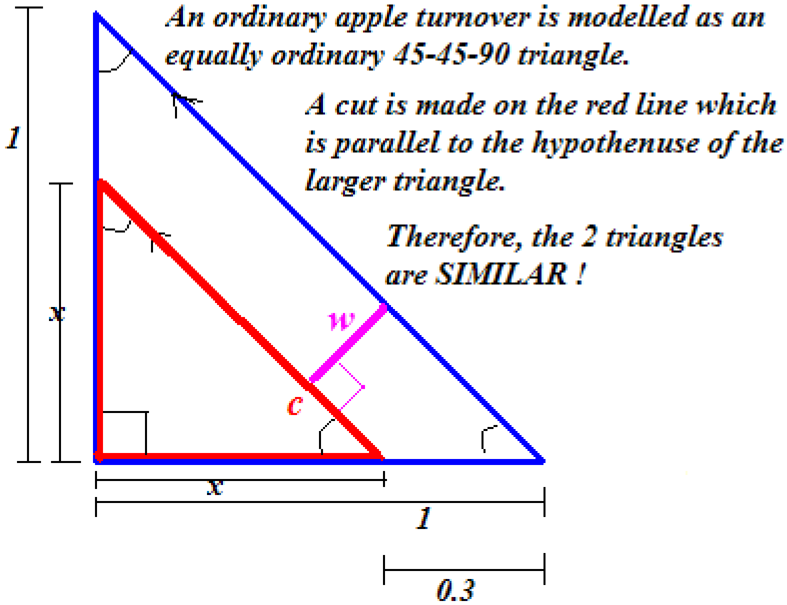


Joe's way

Assume this ruse will work but once.
She's given me this without a fuss.
Is she being nice or playing the dunce?

Compute the **width** of her berry-starved piece.
Recall it's bordered by cut and crease.
By my warped standards the deal was fair –
proving that I can do this at least,
While on my ill-gotten pastry I will now feast!

Another original math poem by **Joe Pawlak.** My ~~anger_management_therapist~~ ~~parole_offficer~~ ~~bookie~~ ~~invisible_friend~~ wife can attest to the calming influence produced by your unconditional approval of my deathless prose.



It will simplify the problem by assuming the thickness is uniform ## and equate the area of the small red triangle to ½ of the area of the original turnover.

I let the legs of the original turnover have length 1. I'll find all other lengths in terms of this length.

$$\frac{1}{2}[\text{area of turnover}] = \text{area of small triangle}$$

$$\frac{1}{2}\left[\frac{1}{2}(1)^2\right] = \frac{1}{2}(x)^2$$

$$\frac{1}{4} = \frac{1}{2}(x)^2$$

$$x = \frac{\sqrt{2}}{2} \cong 0.7$$

Therefore, the cut is made ~ 7/ 10ths of the turnover leg, measured from the right angle. The trapezoidal piece's sides are ~ 3/10ths of the turnover length.

Can we find the value of **c** and **w** in the pic?

Recall we used the fact that the triangles were similar to let the red triangle have equal legs **x**. Since the isosceles right triangle has sides in the ratio $1:1:\sqrt{2}$, the side **c** can be found.

$$\frac{c}{x} = \frac{\sqrt{2}}{1} \rightarrow c = \frac{\sqrt{2}}{1}x = \frac{\sqrt{2}}{1} * \frac{\sqrt{2}}{2} = 1$$ (exactly as long as the original turnover's leg)

w is found by equating the trapezoid area to ½ of the original turnover's area again.

$$\text{trapezoid area} = \frac{1}{2}(base_1 + base_2) * height = \frac{1}{2}(c + base_2) * height$$

$$base_1 = c = 1 \qquad base_2 = \text{turnover hypotenuse} = \sqrt{2}$$

$$\frac{1}{2}(1+\sqrt{2}) * w = \frac{1}{4} \rightarrow w \cong 0.21$$ → **w** is ~ 1/5th of the length of the original turnover's leg.

The assumption of uniform thickness is not truly justified. However, without this simplifying model, I wouldn't be able to use this to ~~torture~~ teach you about similar triangles.

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